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## (54) VEHICLES AND VEHICLE LIFTS

FAHRZEUGE UND LADEBORDWÄNDE

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US-A- 4 685 860

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## Description

THIS INVENTION relates to vehicles and vehicle lifts.

EP-A-0217467 describes a structure mounted on a vehicle which structure in a first condition forms steps for entry to the vehicle and in a second condition forms a horizontal platform which can be raised and lowered.

DE-A-3531853 describes a vehicle lift adapted to be fixed to a vehicle for movement of a load between upper and lower positions, the lift comprising a support for connection to a vehicle, the support comprising elongate means; mounting structure movable relative to the support between inner and outer positions, the mounting structure comprising a platform for receiving the load, and means for moving the platform between the upper and lower positions. The elongate means are straight.

WO-A-88/03484, which is considered to represent the closest prior art, discloses a vehicle lift adapted to be fixed to a vehicle for movement of a load between upper and lower positions, the lift comprising a support for connection to the vehicle, the support comprising laterally spaced rails, mounting structure movable on the rails in relation to the support between inner and outer positions, the mounting structure comprising a platform for receiving the load, and power means for moving the platform between upper and lower positions. The power means comprises a scissor mechanism.

According to the present invention a vehicle lift adapted to be fixed to a vehicle for movement of a load between upper and lower positions comprises a support for connection to the vehicle, the support comprising laterally spaced rails; mounting structure movable on the rails in relation to the support between inner and outer positions, the mounting structure comprising a platform for receiving the load, and power means for moving the platform between the upper and lower positions characterised in that the mounting structure comprises parallelogram structure and in that the spaced rails are curved in an outer region so that the platform changes its orientation to the ground as the mounting structure is moved between the inner and outer positions, and in that the arms of the parallelogram structure are of relative lengths which change the inclination of the platform between the upper and lower positions. This enables the inclination of the platform to change between the upper and lower positions.

Advantageously, the spaced rails comprise upper and lower surfaces, the mounting structure comprising rollers engaging the upper and lower surfaces.

The invention may be performed in various ways and some specific embodiments with possible modifications will now be described by way of example with reference to the accompanying drawings, in which:

- Fig. 1 is a side view of a vehicle with lift;  
 Fig. 2 is a perspective view of part of a lift;  
 Fig. 3 is a perspective view of another part of the lift;

- Fig. 4 is a section through part of Fig. 3;  
 Fig. 5 is a plan view of the lift;  
 Fig. 6 is a rear view of another arrangement;  
 Fig. 7 is similar to Fig. 3;  
 Fig. 8 shows operation of the lift;  
 Fig. 9 shows a modified platform;  
 Figs. 10A, 10B show a modified lift;  
 Fig. 11 shows a drive system;  
 Fig. 12 is an enlarged view of part of Fig. 10A;  
 Fig. 13 shows operation of a lift;  
 Fig. 14 shows a modification;  
 Fig. 15 shows a rail arrangement;  
 Figs. 16, 16A show a modification;  
 Fig. 17 shows a vehicle with rear lift;  
 Fig. 18 is a side view of a platform ramp;  
 Fig. 19 is an end view of part of Fig. 18; and  
 Fig. 20 shows a platform.

Referring to Figs. 1 to 5, a vehicle lift 10 comprises a mounting structure 11 comprising fabricated side members 12, 13 fixed to cross-members 14, 15 with bracing 16. Parallel plates 17, 18 are fixed to the cross members parallel to members 12, 13.

A parallelogram arrangement 20 comprises two pairs of upper and lower side elements 21, 22 and 21a, 22a. The elements in each pair at one end are pivoted at 23, 24 between the sides of members 12, 13 with cut-out 25. At their other ends the elements 21, 22 are pivoted at 23a, 24a to the front of a rear part 26 of a flat platform 27 having a front part 28 which is pivoted to the front of the part 26 so as to be movable between an open position (Fig. 3) and a closed position (A in Fig. 1). The platform is shown open in full line in Fig. 1. The elements in each pair 21, 22 and 21a, 22a nest within each other at all times so that no gap exists between them as viewed sideways; this is a safety feature.

Towards their rear ends the upper elements 21, 21a are connected by a cross-member 29 to which are fixed two arms 30, 31 respectively pivoted to plates 17, 18 at 32, 33 on a common transverse axis 34a which is in line with pivots 23. A hydraulic piston/cylinder ram 34 is located between plates 17, 18 and the piston 35 is pivoted at 36 to cross member 29 and the cylinder pivoted at 37 to cross member 14. Pivot 36 is spaced from axis 34a.

When the ram 34 is energised and deenergised the parallelogram arrangement 20 is pivoted up and down (see Fig. 1). In use, the platform remains substantially horizontal.

The mounting structure 11 is movable between side rails or supports 40, 41 between an outer or operative position (Fig. 2) and an inner or inoperative position, shown dotted at B in Fig. 1. Any suitable means may be used but as shown the outer faces 42 of members 12, 13 are provided with two or more spaced bosses 43 having upper and lower plastics pieces 44, 45 in sliding engagement with plastics liners 46, 47 on the confronting faces of the upper and lower arms of the rails 40, 41. Brackets 48 (only one shown) are respectively fixed to

the members 12, 13 and are secured to respective chains 49 extending round sprockets 50, 51 secured to the rails 40, 41. A motor 52 e.g. electric, can rotate the sprockets 51 on a common axle to move the structure 11 in and out on the rails.

It will be understood that because the elements 21, 22 and 21a, 22a are inwards of rails 40, 41 the ram 34 can be operated to raise or lower the platform at all positions of the structure in relation to the rails 40, 41.

The lift 10 is intended primarily for use by the disabled and handicapped, in particular with wheel-chairs, and for mounting beneath the floor 60 of a vehicle. Fig. 1 illustrated mounting beneath the rear of a vehicle having a rear door, and rear bumper 61.

If there is sufficient room beneath the vehicle the lift can be mounted with rails 40, 41 horizontal. However it is often the case that vehicle structure beneath the floor 60 prevent this unless the lift structure undesirably enters into the space 62 beneath the minimum angle of departure 63 which normally extends upwards and rearwards from the point of contact between the rear wheels 64 and ground 65. Thus in the example of Fig. 1, brackets 70 are fixed to spaced fore-and-aft chassis members 71 of a monocoque body 72, and act as rear mounting for leaf springs 73. In the present lift, the rails 40, 41 can be mounted on the vehicle so as to be inclined upwards as they extend rearwards so that the inner ends C of the rails are below the springs 73 but the outer ends D are not beneath the angle of departure but are still beneath the bumper.

The pivots 23, 24 and 23a, 24a are vertically spaced. The platform remains substantially horizontal.

The parallelogram is made so that the separation between pivots 23, 24 is slightly (e.g. 2mm) less than the separation between pivots 23a, 24a so that in the down position the platform inclines slightly downwards as it extends outwards and in the top position the platform is inclined slightly upwards as it extends outwards. This is a safety feature. See also Fig. 13. The term parallelogram arrangement should be understood as including such an arrangement.

In the withdrawn position the platform can be raised between the rails to be parked between the chassis members 71, subject to their spacing, and lightly held in contact with the body to resist rattle.

The lift can be mounted to extend sideways and as shown in Fig. 6 the rails may in some cases incline downwards enabling the lift to be mounted in cases where the prop shaft 80 would effectively prevent horizontal mounting.

Fig. 7 is generally similar to Figs. 2 and 3 but the motor 52 is central. Figs. 8 shows operation of a lift in association with a rear door of a vehicle. The platform may have a pivoted flap 76 to bridge any gap between the platform and the floor 76a of the vehicle.

As shown in Fig. 9 the platform can be in two parts 110, 111 which are slidably cooperable. In this way the platform can be manually extended.

The arrangement of Figs. 10A, 10B is similar to Figs. 2, 3 but, as shown, is intended for sale as a kit of parts and cross-members 81, 82 are fixed to rails 83, 84. The cross-members 81, 82 can be omitted if the rails are individually fitted to the vehicle. In this arrangement the rails 83, 84 have a vertical web 85, an inwardly directed horizontal arm 86 at the top of web 85 and a downwardly and inwardly inclined web 87 at the bottom of web 85.

Spaced along the inner face of web 85 are spacers 88 to which is connected an elongate running rail 89 and each side of the structure 11 is provided with rollers 90, 91, engaging the upper and lower edges of rail 89, and rollers 92, rotating about vertical axes, engaging the inner face 93 of exposed rail 89. This arrangement resists accumulation of dirt as might interfere with proper operation, the dirt tending to wash or fall out of rails 83, 84. The structure 11 is moved in and out by motor 94 driving sprocket 95 engaging chain 96 which extends over sprockets 97 and is connected at its ends to cross members 81, 82 (see Fig. 11). As before the rails 83, 84 could be inclined.

Releasable means may hold the structure 11 in a forward and rearward position. These means could be remote controlled but as shown comprise latches 100 engageable behind or in front of parts of structure 11 and connected to rods 101 which can be rotated, against the bias of springs 102, by handle 103 to move the latches from the path of structure 11, a transverse rotatable rod 104 connecting the latch mechanisms at the two sides.

In another arrangement a manually releasable neck-type latch hook is mounted on the cross-members 81, 82 cooperable with latches on the front and rear of structure 11.

The ram 34 is inclined downwards and pivots on bar 36 fixed to plates 30, 31 at a position spaced from and lower than axis 34a. The plates 30, 31 are fixed to cross member 29 fixed to upper parallelogram elements 21.

A feature of Fig. 10a, which can be used in the other embodiments in which the platform slightly changes its orientation as it is moved up and down is that the lower arms 22, 22A of the parallelogram can be slightly reduced in length compared with upper arms 21, 21A. This controls (Fig. 13) the position at which the platform is horizontal as it moves between an incline slightly downwards as it extends outwards when in the lowered position and an incline slightly upwards as it extends outwards in the raised position. The term parallelogram arrangement should be understood as including this modification.

In a modification Fig. 14 the sprockets 97 are positioned on top of structure 11 for rotation about vertical axes; this is for cases in which there is appropriate room beneath the vehicle, and provides an alternative drive means for the structure 11 which may enable the overall height of the lift 10 to be reduced.

In an advantageous embodiment of Figs. 15, 16, 16A the platform has a pivoted part 112 which, in the raised and extended, or an intermediate and extended, position, can be folded inwards to form a step 113.

The extent to which the platform is raised by the ram can be adjusted by changing the position of pivot 36.

Fig. 17 shows a vehicle with rear door 113 and lift 10 having a platform 115 movable by, for example, a parallelogram lift device between lowered position on the ground and a raised position providing entry to the door. The door could be on the vehicle side. The lift may be stowable, for example beneath the vehicle floor, by a rotary action or sliding action.

The platform has an inner part 76 which forms a stop and a bridge plate and an outer part 114, which forms a wheel-chair stop and a ramp.

The part 114 automatically moves to a raised (wheel-chair stop) safety position when the platform is raised away from the ground, and automatically forms a ramp when the platform is in contact with the ground. The down ramp provides an upwardly inclined surface as it extends inwards.

At the outer end of the main platform 115 is a cross-member 130 having at each end a shoe 131 adapted to engage the ground and biased downwards by a spring 116. A pin 132 secured to link 133 has a lost motion connection in a slot 134 in an upstanding part 135 of the shoe. The link 133 is pivoted at 136 to a side wall 119 of the platform and has a pin 137 engageable with a tongue 138 on the part 114.

When the platform is being lowered, the part 114 is in the dotted position. The shoes 131 engage the ground and are moved upwards relative to the platform 115 against the action of the springs 116 and the links 133 are moved from the dotted to the full line position, taking the links over-centre and the part 114 moves to the full line position under gravity. Upward movement of link 133 is limited by engagement of member 130 in a recess 140 in the structure. The link arrangement provides a mechanical advantage.

The ramp part 114 moves under gravity and thus resists damage by engagement with a stone, and if accidentally engaging a user's foot for example will not damage the foot. On being raised from the ground, the springs 116 move over centre and move the shoes and links downwards and pivot the part 114 to the up, dotted, safety position. Downwards movement of the links is limited by engagement with stops 141. With ramp 114 up, this acts to resist movement of an article, e.g. a wheel-chair, off the platform away from the vehicle.

A pivoted hand rail 150 is provided.

As shown in Fig. 15, the rails 89 are shaped so as to have a horizontal outer portion 89a connected by a curved portion 89b to a straight, stowage, portion 89c parallel to supports 83, 84. In this way, the structure 11, and the platform, are stowed in an inclined position but on being moved outwards adopt a horizontal position.

The lift may include electric control apparatus, including a hand-held switch box, and including limit switches for controlling the in and out movement of structure 11 and the operation of the ram and the up and down movement of the parallelogram.

## Claims

1. A vehicle lift adapted to be fixed to a vehicle for movement of a load between upper and lower positions, the lift comprising a support for connection to the vehicle, the support comprising laterally spaced rails (40, 41; 89); mounting structure (11) movable on the rails (40, 41; 89) in relation to the support between inner and outer positions, the mounting structure (11) comprising a platform (27) for receiving the load, and power means (34) for moving the platform (27) between the upper and lower positions characterised in that the mounting structure (11) comprises parallelogram structure (20) and in that spaced rails (40, 41; 89) are curved (89b) in an outer region so that the platform (27) changes its orientation to the ground as the mounting structure (11) is moved between the inner and outer positions, and in that the arms (23 - 24, 23a - 24a, 21 or 22, 21a or 22a) of the parallelogram structure (20) are of relative lengths which change the inclination of the platform between the upper and lower positions.
2. A vehicle lift as claimed in Claim 1, characterised in that the parallelogram structure (20) has upper and lower longer arms (21 or 21a, 22 or 22a) and inner (23 - 24) and outer (23a - 24a) shorter arms characterised in that the inner shorter arm (23 - 24) is shorter than the outer shorter arm (23a - 24a).
3. A vehicle lift as claimed in Claim 1 or Claim 2, in which the parallelogram structure (20) has upper and lower longer arms (21 or 21a, 22 or 22a) and inner (23 - 24) and outer (23a - 24a) shorter arms characterised in that the lower longer arm (22 or 22a) is shorter than the upper longer arm (21 or 21a).
4. A vehicle lift as claimed in any preceding claim, characterised in that the rails (89) comprise upper and lower surfaces, the mounting structure (11) comprising rollers (90, 91) engaging the upper and lower surfaces.

## Patentansprüche

1. Fahrzeuglift, der zur Befestigung an einem Fahrzeug bestimmt und geeignet ist, um eine Last zwischen einer oberen und einer unteren Stellung zu bewegen, wobei der Lift einen mit dem Fahrzeug verbindbaren Träger aufweist und der Träger seitlich im Abstand angeordnete Schienen (40, 41; 89) aufweist, mit einer Lagereinrichtung (11), die auf den Schienen (40, 41; 89) relativ zu dem Träger zwischen einer inneren und einer äußeren Stellung bewegbar ist, wobei die Lagereinrichtung (11) eine Plattform (27) zur Aufnahme der Last aufweist, und eine Antriebseinrichtung (34), um die Plattform (27) zwischen der oberen und unteren Stellung zu bewe-

gen, dadurch gekennzeichnet, daß die Lagereinrichtung (11) eine Parallelogrammanordnung (20) aufweist und daß die im Abstand angeordneten Schienen (40, 41; 89) in einem äußeren Bereich gekrümmt (89b) sind, so daß die Plattform (27) ihre Ausrichtung zum Boden ändert, wenn die Lagereinrichtung (11) zwischen der inneren und der äußeren Stellung bewegt wird, und daß die Arme (23-24, 23a-24a, 21 oder 22, 21a oder 22a) der Parallelogrammanordnung (20) relative Längen haben, die die Neigung der Plattform zwischen der oberen und der unteren Stellung ändern.

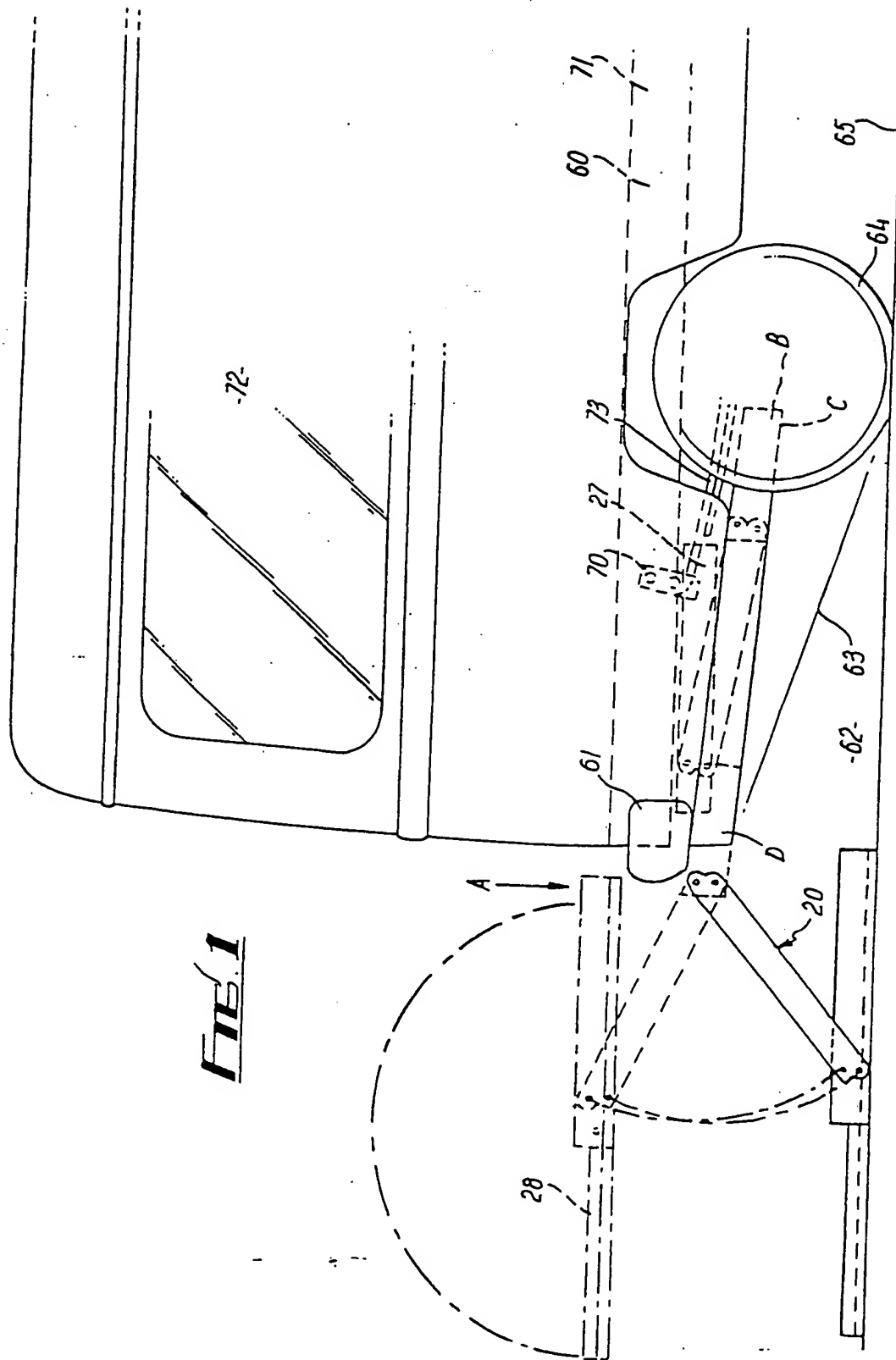
2. Fahrzeuglift nach Anspruch 1, dadurch gekennzeichnet, daß die Parallelogrammanordnung (20) obere und untere längere Arme (21 oder 21a, 22 oder 22a) und innere (23-24) und äußere (23a-24a) kürzere Arme hat, dadurch gekennzeichnet, daß der innere kürzere Arm (23-24) kürzer ist als der äußere kürzere Arm (23a-24a).
3. Fahrzeuglift nach Anspruch 1 oder 2, bei dem die Parallelogrammanordnung (20) obere und untere längere Arme (21 oder 21a, 22 oder 22a) und innere (23-24) und äußere (23a-24a) kürzere Arme hat, dadurch gekennzeichnet, daß der untere längere Arm (22 oder 22a) kürzer ist als der obere längere Arm (21 oder 21a).
4. Fahrzeuglift nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die Schienen (89) obere und untere Flächen aufweisen und daß die Lagereinrichtung (11) Rollen (90, 91) aufweist, die mit den oberen und unteren Flächen in Eingriff stehen.

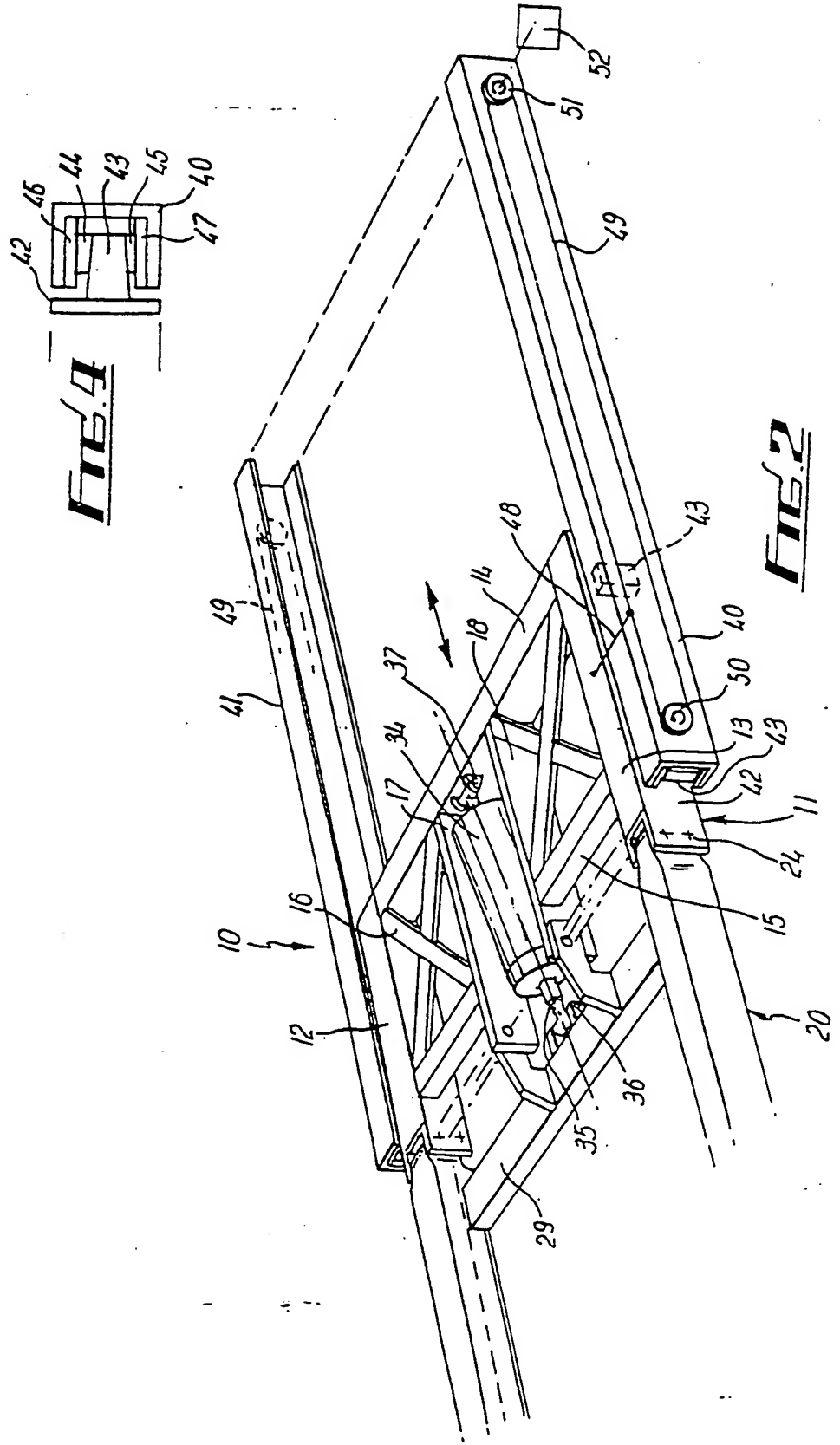
#### Revendications

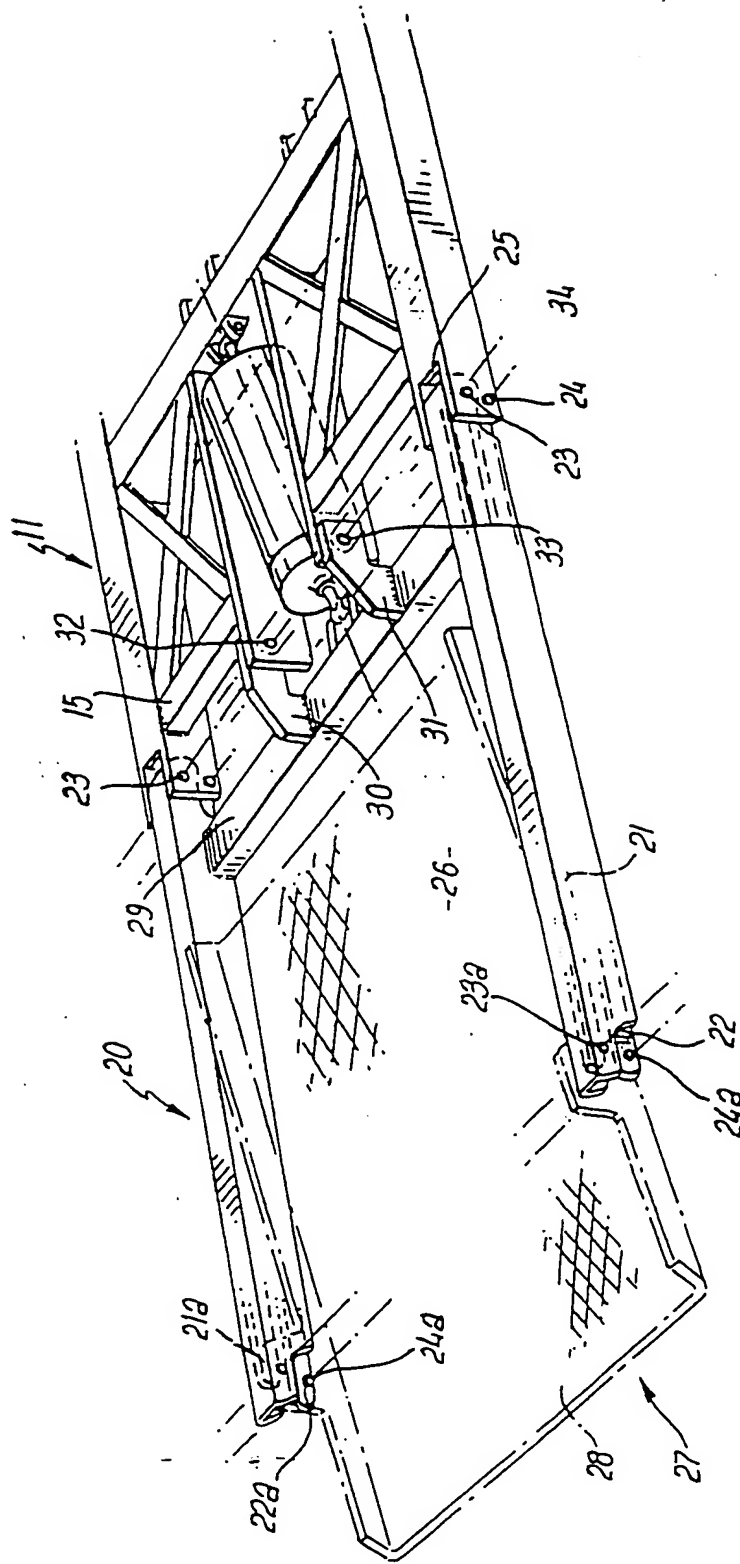
1. Système de levage pour véhicule adapté pour se fixer à un véhicule destiné à déplacer une charge entre des positions haute et basse, le système de levage comprenant un support destiné à la fixation au véhicule, le support comprenant des rails espacés latéralement (40, 41; 89); une structure (11) de montage mobile sur les rails (40, 41; 89) par rapport au support entre des positions intérieure et extérieure, la structure de montage (11) comprenant une plate-forme (27) destinée à recevoir la charge, et un moyen moteur (34) destiné à déplacer la plate-forme (27) entre des positions haute et basse, caractérisé en ce que la structure (11) de montage comprend une structure (20) de parallélogramme et en ce que les bras espacés (40, 41; 89) sont incurvés (89b) dans une région extérieure en sorte que la plate-forme (27) modifie son orientation par rapport au sol lorsque la structure (11) de montage se déplace entre les positions intérieure et extérieure, et en ce que les bras (23 - 24, 23a - 24a, 21 ou 22, 21a ou 22a) de la structure (20) de parallélogramme

ont des longueurs relatives qui modifient l'inclinaison de la plate-forme entre les positions haute et basse.

2. Système de levage selon la revendication 1, caractérisé en ce que la structure (20) de parallélogramme possède des bras supérieur et inférieur (21 ou 21a, 22 ou 22a) plus longs et des bras intérieur (23 - 24) et extérieur (23a - 24a) plus courts caractérisé en ce que le bras intérieur plus court (23 - 24) est plus court que le bras extérieur plus court (23a - 24a).
3. Système de levage selon la revendication 1 ou la revendication 2, dans lequel la structure (20) de parallélogramme possède des bras supérieur et inférieur (21 ou 21a, 22 ou 22a) plus longs et des bras intérieur (23 - 24) et extérieur (23a - 24a) plus courts caractérisé en ce que le bras intérieur plus long (22 ou 22a) est plus court que le bras supérieur plus long (21 ou 21a).
4. Système de levage selon une quelconque des revendications précédentes, caractérisé en ce que les rails (89) comprennent des surfaces supérieure et inférieure, la structure (11) de montage comprenant des galets (90, 91) s'engageant avec les surfaces supérieure et inférieure.

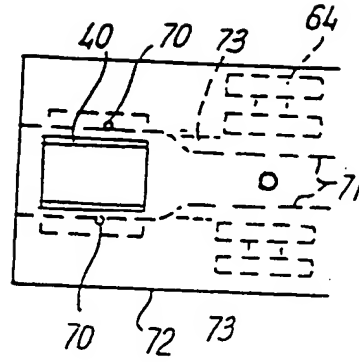




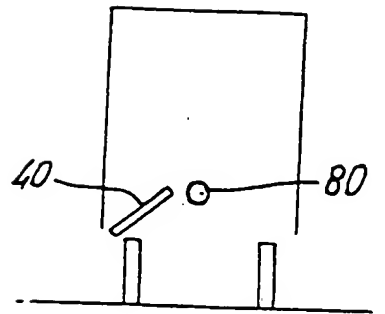


**FIG. 3**

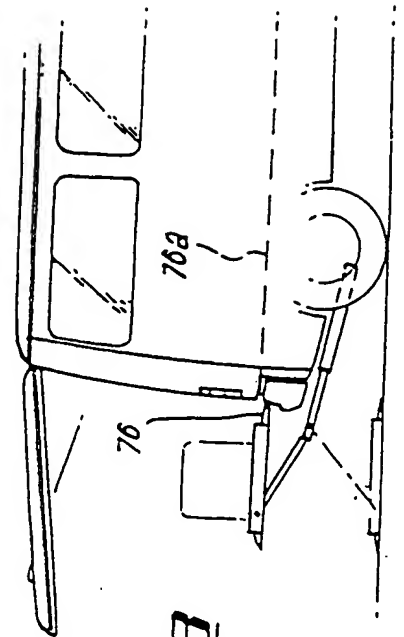
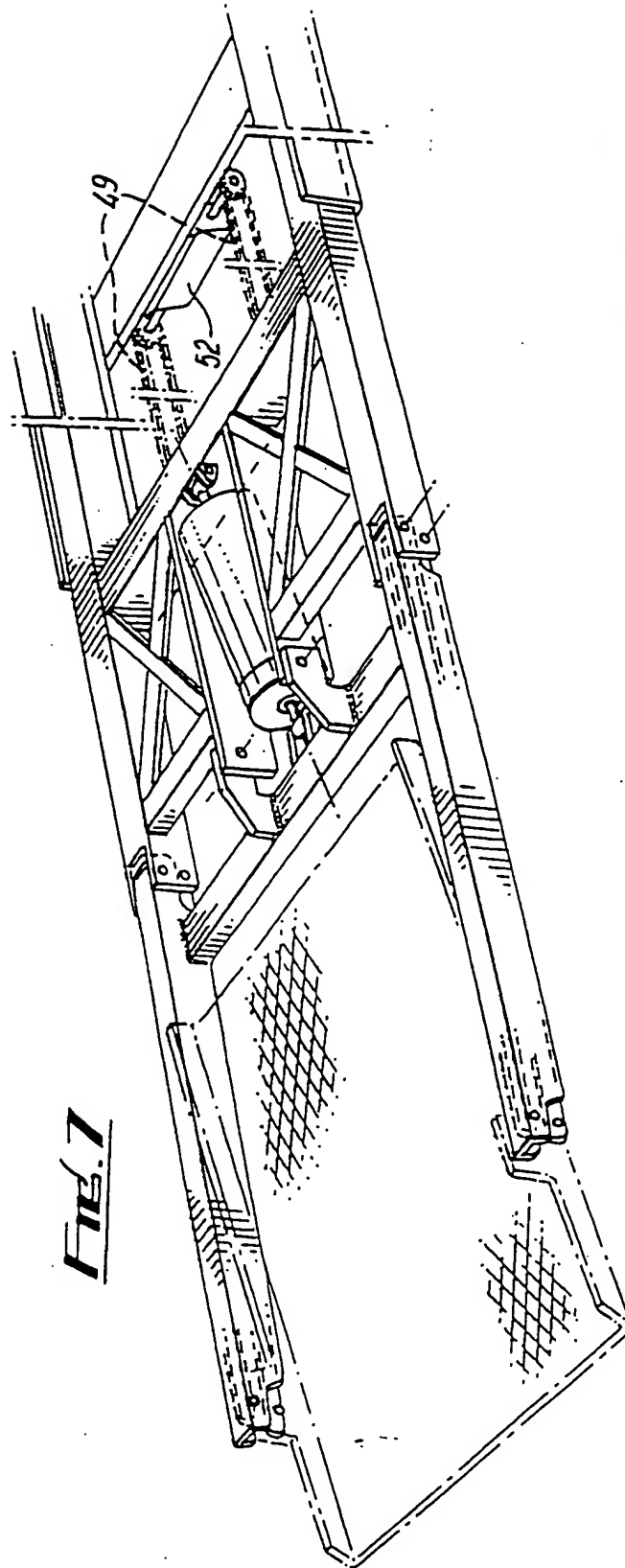


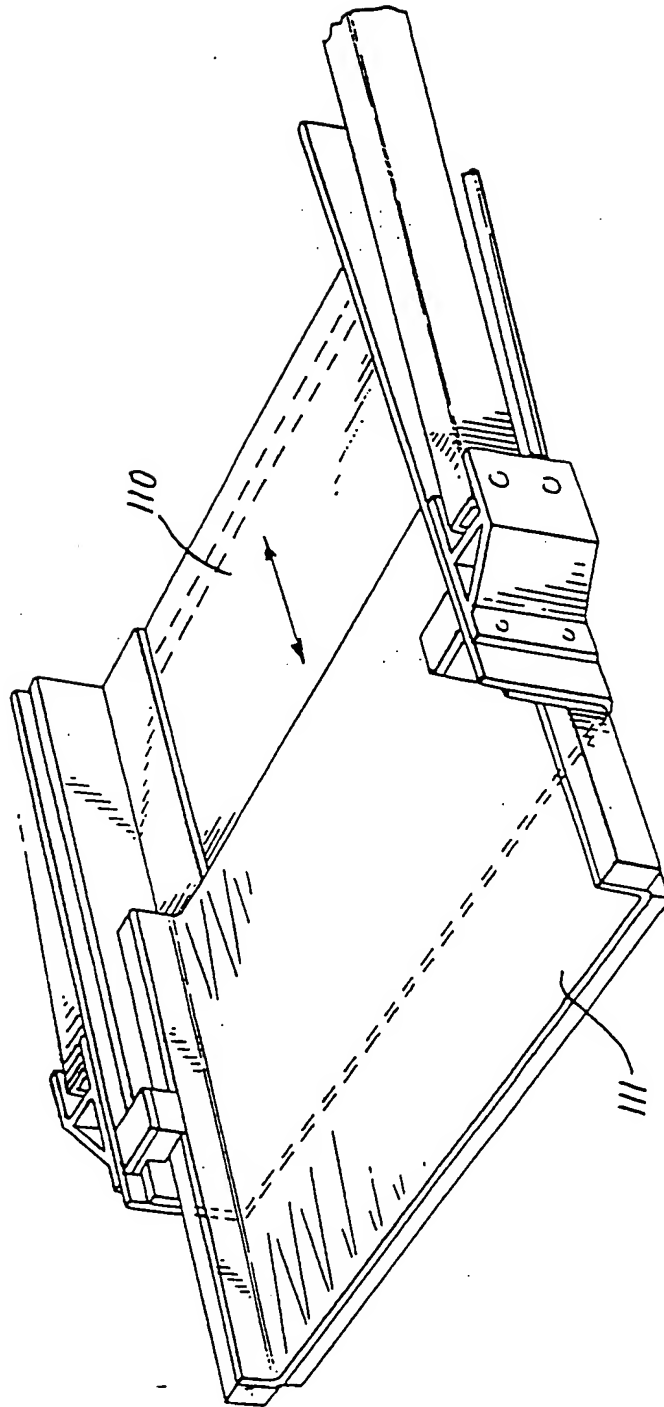


**FIG. 5**

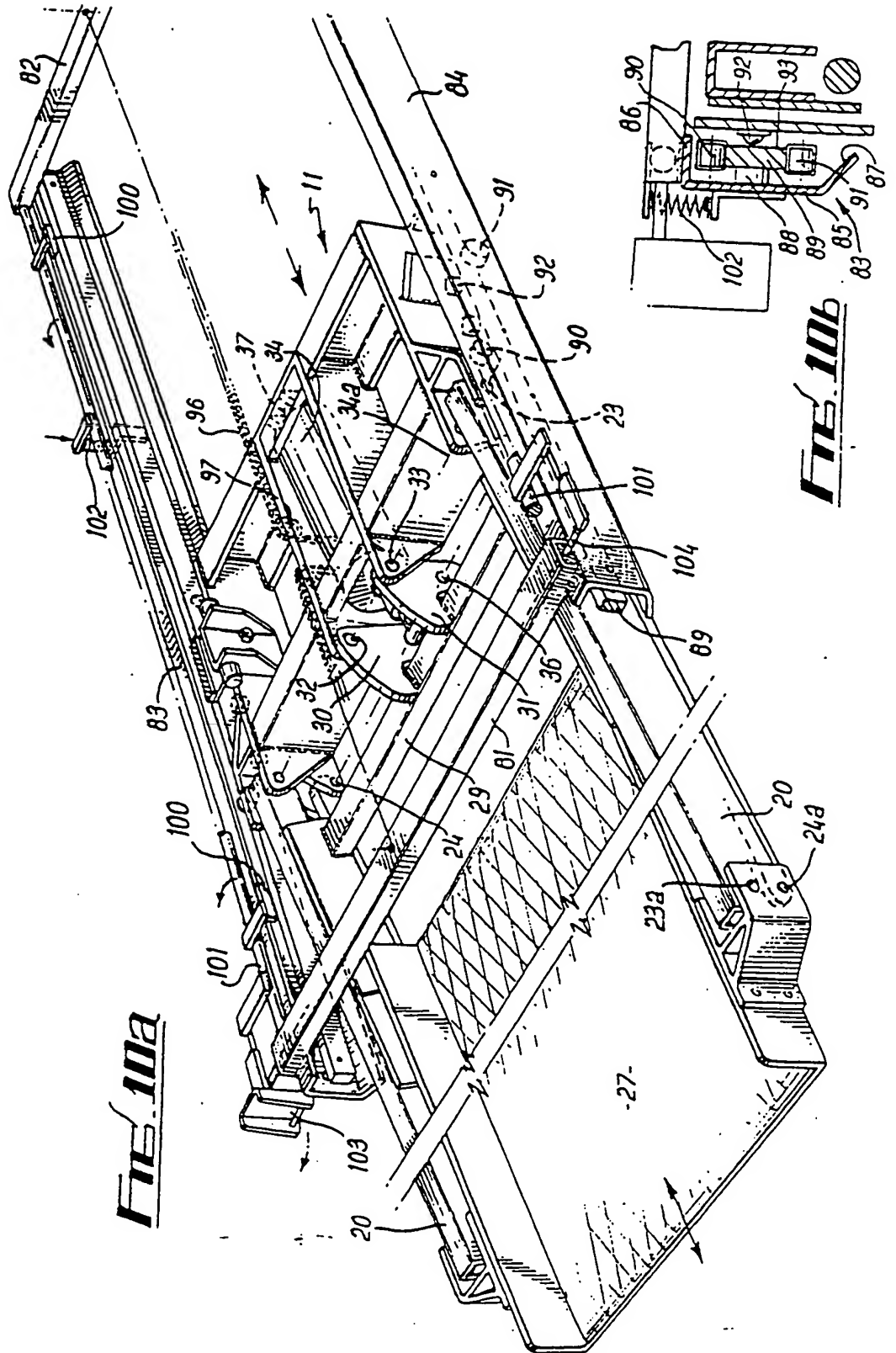


**FIG. 6**



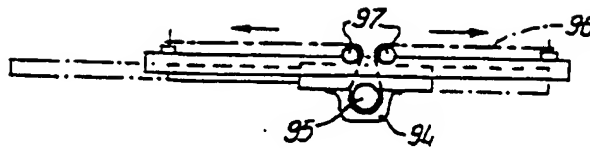


**Fig. 9**

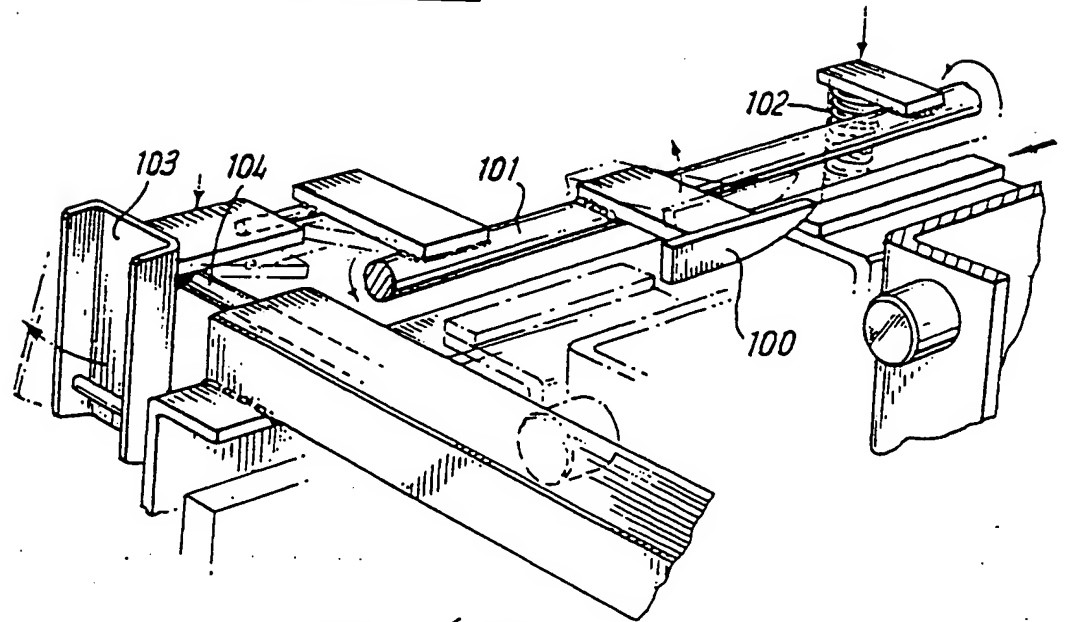


**Fig. 10a**

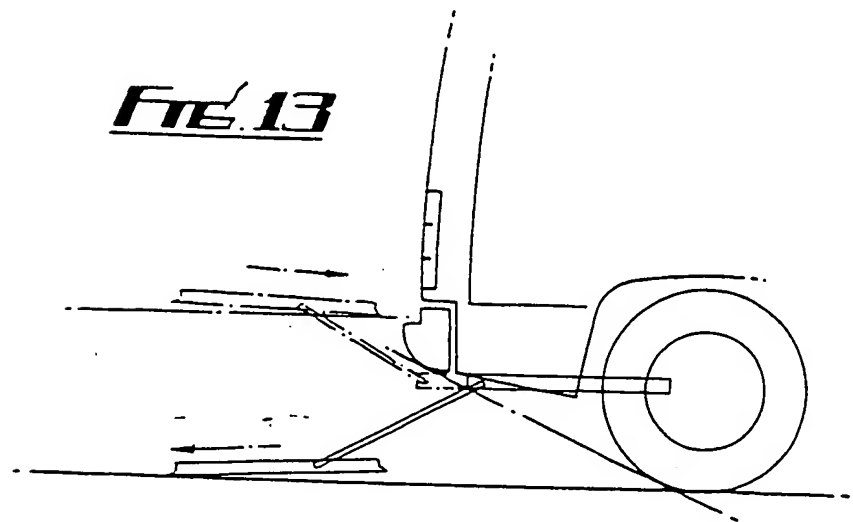
**Fig. 10b**



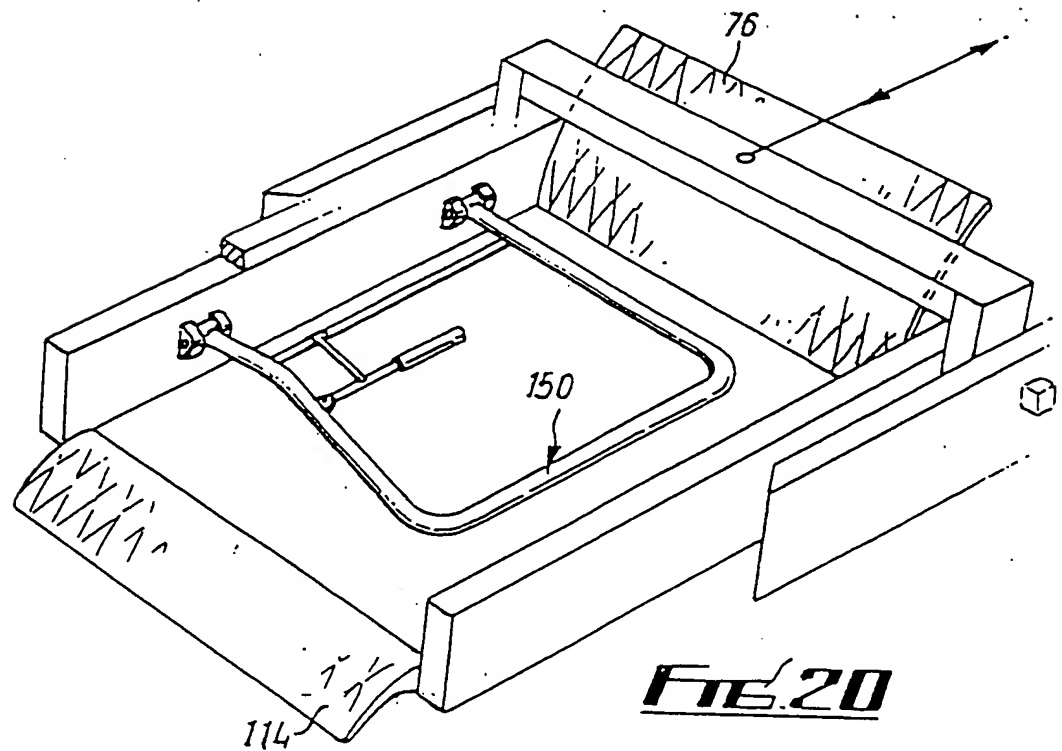
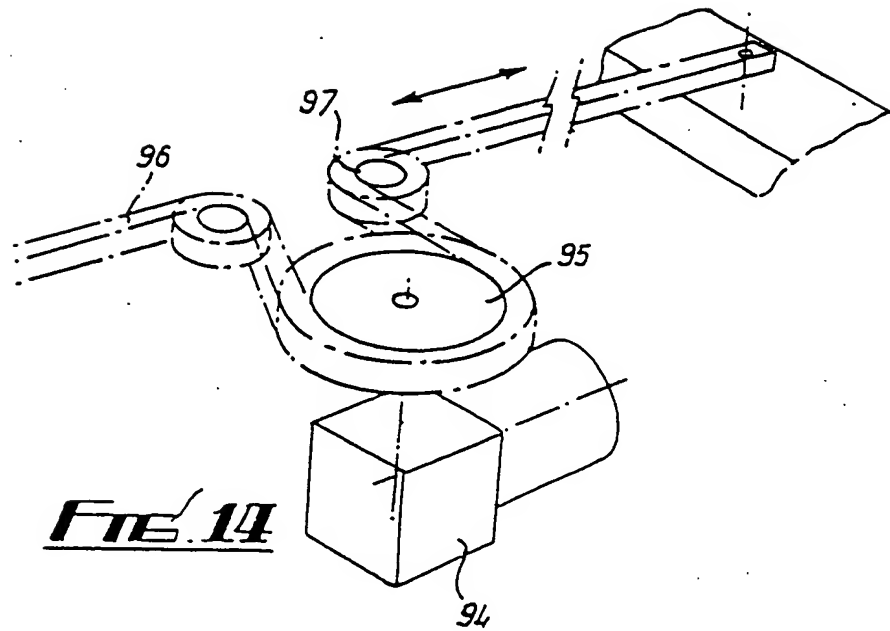
**FIG. 11**

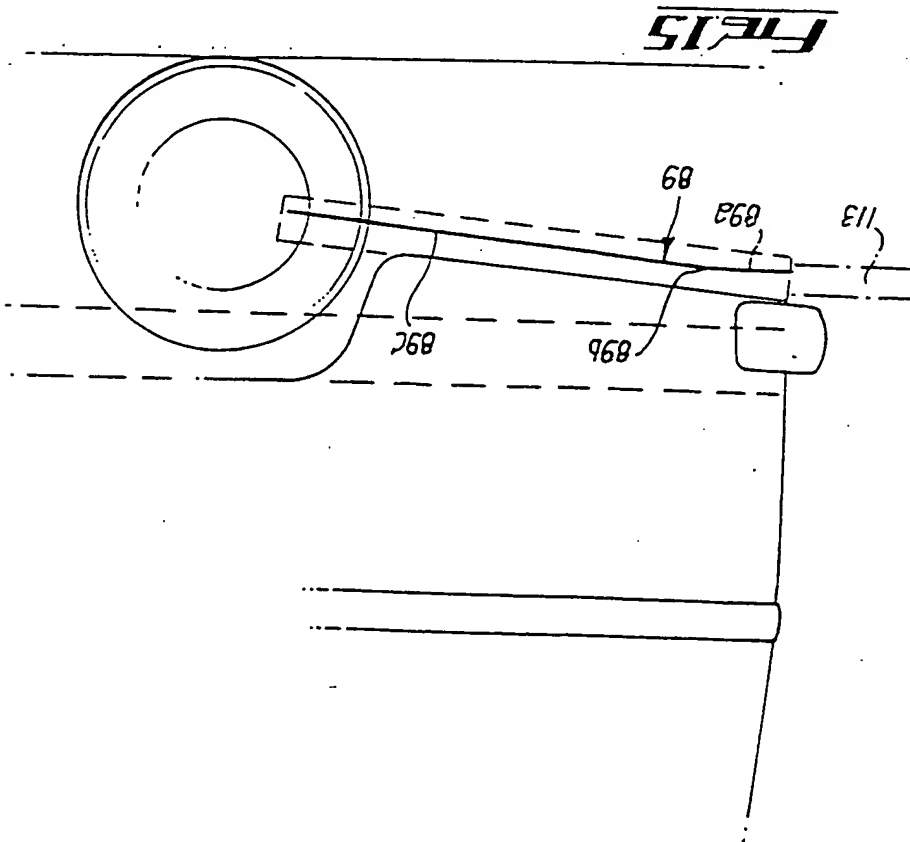
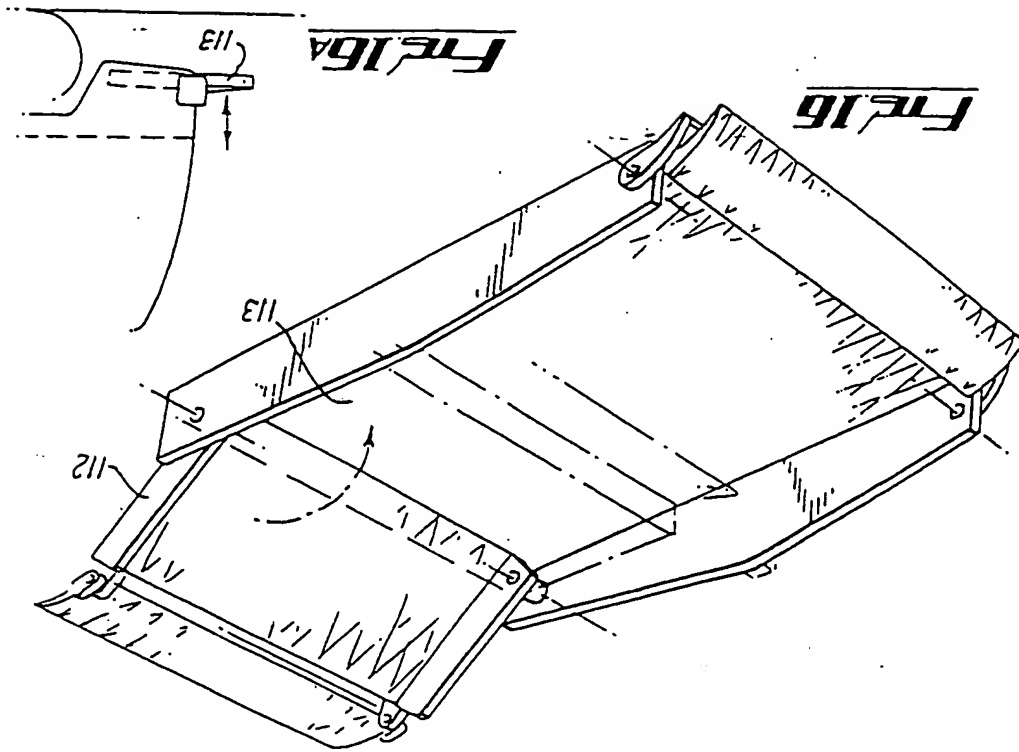


**FIG. 12**



**FIG. 13**





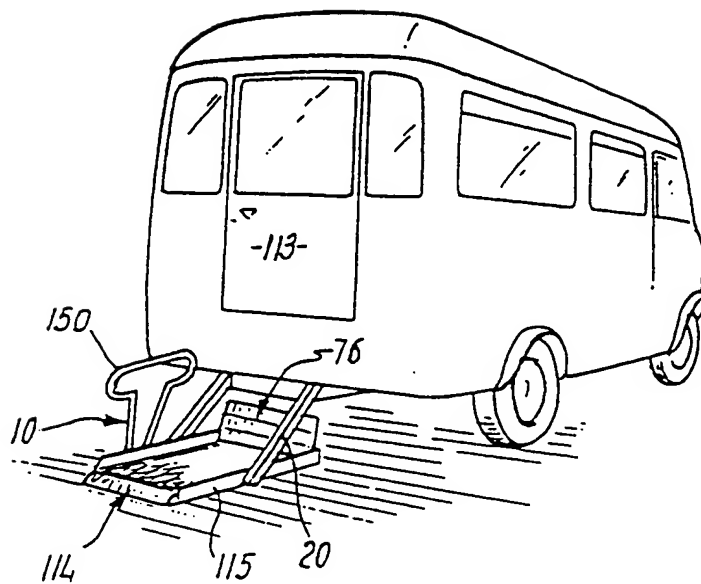
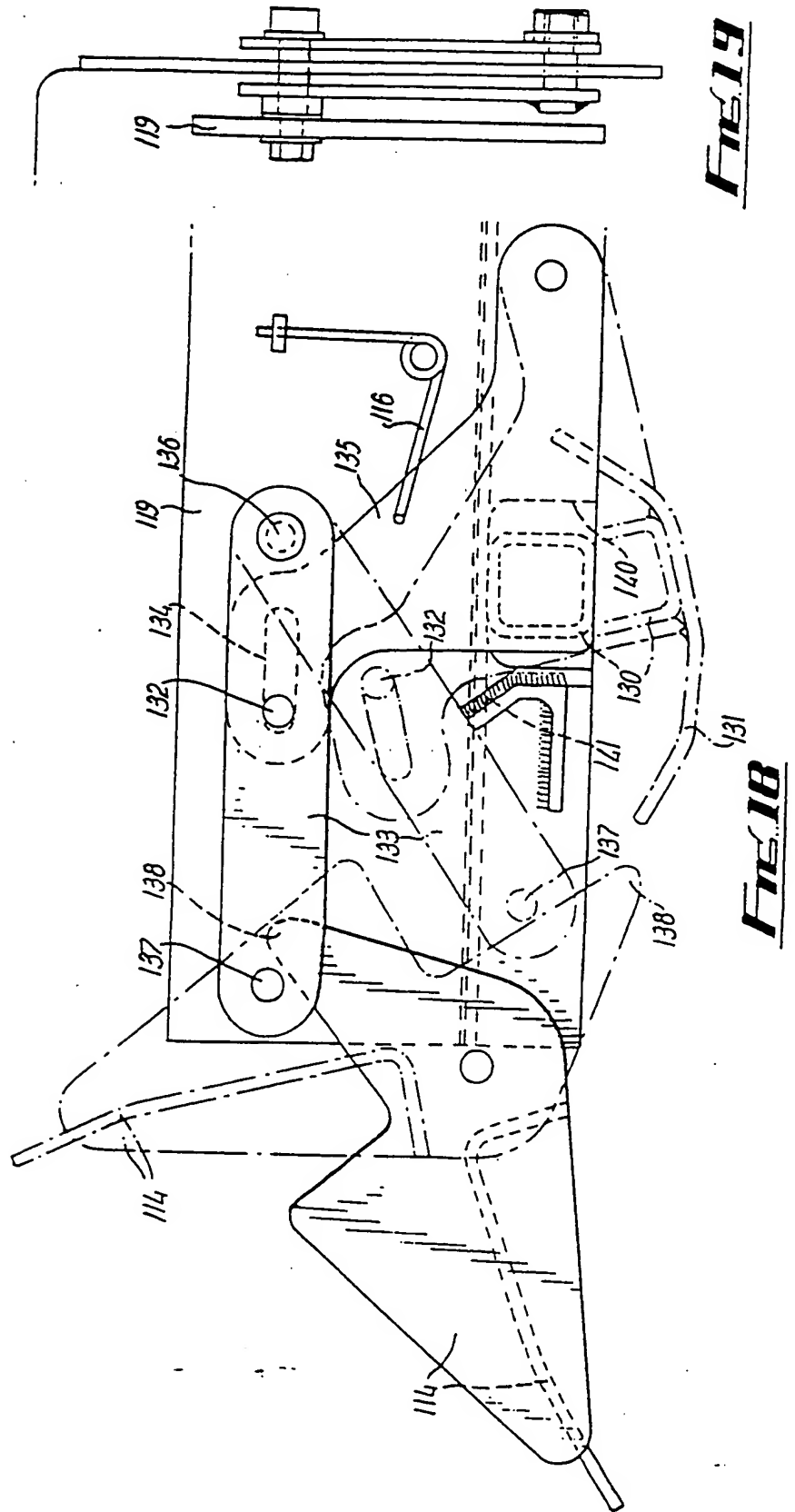
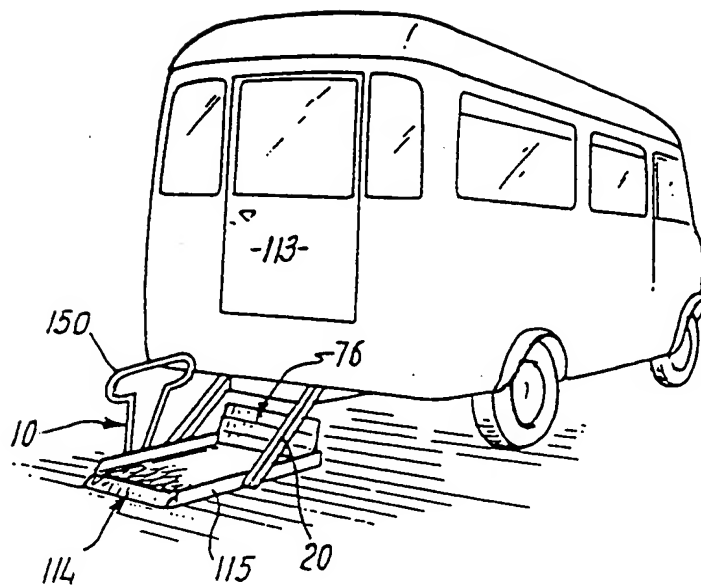


FIG. 17







**FIG. 17**